

STEPHON H ALEXANDER
Curriculum Vitae

Department of Physics and Astronomy
The Koshland Center for Integrated Natural Sciences
Haverford College
Haverford, PA 19041
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email: stephonalexander@mail.mac.com

Citizenship: U.S

Languages: English, Spanish

Education:

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| 2000 | Brown University | Ph.D. Physics <i>Thesis Advisor: Professor Robert Brandenberger</i> <i>Thesis: "Topics at the Interface of String Theory and Cosmology"</i> |
| 1996 | Brown University | Sc.M Electrical Engineering |
| 1995 | Brown University | Sc.M Physics |
| 1993 | Haverford College | B.S Physics <i>Senior Thesis: "On Barkhausen Noise and Magnetic Hysteresis"</i> |

Fellowships and Awards:

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| 2007 | NSF CAREER Award, Cosmology, High Energy Theory |
| 2007 | Foundational Questions in Physics and Cosmology Grant |
| 2006 | Columbia University Teacher's College, Community Leadership Award |
| 2005-present | National Geographic Society Emerging Explorer Membership |
| 2002 | Issac Newton Institute for Mathematical Sciences Junior Fellow, Cambridge University |
| 2000-2002 | PPARC Postdoctoral Fellow |
| 1998-2000 | GANN Fellow |
| 1997-98 | NASA Space Grant Fellow |
| 1994-present | New England Board of Higher Ed. Scholar |
| 1991 | Hansiker award in Mathematics |
| 1989-93 | Ira D.E.A Reid College Scholarship |

Research Interests:

Theoretical cosmology at the interface with particle physics, string theory and quantum gravity

Including:

Baryogenesis, CMB Physics, Dark Energy/Cosmological Constant Problem,

Topological Defects/Solitons, Non-Perturbative QFT, Physics Beyond the Standard Model, Dark Matter

Professional Appointments:

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| Nov 2008 | Moore Visiting Professor The California Institute of Technology, CA |
| Present | Associate Professor of Physics Haverford College, PA |
| Present | Adjunct Professor of Physics Penn State University, PA |
| 2005-2008 | Assistant Professor of Physics Penn State University, PA |

Postdoctoral Research Experience:

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| Present | Theory Postdoctoral Researcher, SLAC and Institute for Theoretical Physics Stanford University, CA |
| 2000-2002 | Theory Postdoctoral Researcher, Imperial College, London, U.K |
| 2001-2002 | Visiting Postdoctoral Researcher, ISCAP Institute, Columbia University, N.Y |
| 2000-2005 | Visiting Postdoctoral Researcher, Perimeter Institute, Waterloo, Canada |

General Research Experience:

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| Spring 1996 | Research in Quantum Heterostructures, Electrical Engineering, Brown University, RI |
| 1994-95 | Research in Protein Structure Determination, X-ray Crystallography, Biophysics Dept., Harvard University, MA |
| 1993-94 | Science Education Research, University of Pennsylvania, PA |
| Summer 1994 | Physics Education Research, City on A Hill Charter School, MA |
| Summer 1993 | Computer Engineering Research, Carnegie Mellon University, PA |

Professional Appointments:

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| Present | Board of Directors Network for the Improvement of World Health |
| Present | Emerging Explorer The National Geographic Society |
| Present | Scientific Member Institute for Gravitation and the Cosmos |
| Present | Member National Society of Black Physicists |

Teaching Experience:

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| Fall- Spring 2007-8 | Taught sophomore level, Modern Physics and Intro Quantum, Penn State |
| Spring 2007 | Developed and taught graduate level course on the Standard Model of Particle Physics, Penn State |
| Spring 2006 | Developed and taught graduate level course in cosmological perturbation theory and the CMB, Penn State |
| June 2004 | Taught Cosmology Course, COSM Summer School, JLAB, U.S. |
| July 2003-5 | Group Mentor, Young Physicists of Canada, YPC, Perimeter Institute, Canada |
| June 2003 | Physics Teacher, GAMS Summer School, NASA/UMD |
| 2000-2002 | Teaching Postdoctoral Fellow, Imperial College |
| 1997-2000 | Math and Physics Volunteer Teacher, Providence Public Schools |
| Summer 1996 | Taught Freshman Physics, Brown Summer Session, Brown |
| Summer 1995 | Science Teacher, Brown Summer School, Brown |
| Summer 1994 | Summer High School Physics Teacher, City on a Hill Charter School |

Outreach Activities:

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| Nov 2008 | Keynote Address, National Science Teachers Conference, Dallas, TX |
| August 2008 | Presentation, Google Complex |
| June 2008 | Keynote Address, National Oceanic and Atmospheric Administration |
| June 2008 | Featured Video Interview, www.Bigthink.com |
| Nov 2007 | Public Lecture, Research Unplugged, Downtown Theatre, State College, PA |
| Nov 2007 | Discover Magazine Article on Dark Energy co-authored with Jaron Lanier |
| Sept 2007 | Keynote Speaker: National Institute for Teaching and Mentoring |
| June 2007 | NOVA Science Now, Interview on the physics of the LHC |
| June 2007 | Entertaining Science Presentation, The Cornelia St. Cafe, NYC, N.Y |
| June 2006 | The Ensemble Studio Theatre, Cabaret Scientifique, Lecture and Performance |
| May 2006 | National Geographic Society, Explorer Symposium Presentation, Wash D.C. |
| February 2006 | Columbia University Teachers College, Keynote Speaker |
| 2006-Present | National Geographic Emerging Explorer |
| October 2005 | Appearance on NOVA Feature $E = mc^2$ |
| 2004-2005 | World Year of Physics, Quantum Diaries Web Blogger |
| Fall 2005 | Imagine Magazine for Talented Youth |
| Winter 2005 | World Wide web cast at the Exploratorium |
| Winter 2004 | Music and Physics Lecture and Performance, Duke University Music and Physics |
| Winter 2003 | Performed at Roald Hoffman's Entertaining Science in N.Y. |

Invited Seminars and Conference Talks:

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| March 2009 | Plenary Speaker National Academy of Sciences Frontiers of Science Symposium India |
| Nov 2008 | The Cosmological Constant: Change we Can Believe in Cal Tech |
| March 2008 | “The Origin of Galactic Magnetic Fields from String Theory” University of Pennsylvania |
| February 2008 | “Overview of Cosmology” The Annual Meeting of National Society of Black Physicists |
| October 2007 | Theory Seminar, University of Pennsylvania “The Baryon Asymmetry, Inflation and String Theory” |
| October 2007 | Colloquium, Haverford College “Dark Energy: The Mr Hyde of Cosmic Inflation” |
| August 2007 | Theory Seminar, Mc Gill University, Canada “Emergent Inflation.” |
| June 2007 | Joint Theory Seminar, Carnegie Mellon University, University of Pittsburgh “Can we Detect the Baryon Asymmetry with Gravity Waves in the CMB?” |
| May 2007 | Public Lecture: National Geographic Society Headquarters, Wash. D.C. “The Dark Mysteries of the Universe” |
| Sept 2006 | Colloquium, Colgate University “Dark Energy: The Cosmological Constant in Disguise” |
| Aug 2006 | Seminar, University of Amsterdam “Quantum Gravity and the Cosmological Constant” |
| Aug 2006 | Seminar, University of Utrecht “Quantum Gravity and the Cosmological Constant |
| Aug 2006 | Invited Seminar, UC Berkeley Astrophysics “The WMAP Anomaly meets the Anomaly” |
| March 2006 | Invited Seminar, ISCAP, Columbia University “The WMAP Alignment Anomaly and Parity Violation in the CMB” |
| Feb 2006 | Invited Seminar, National Society of Black and Hispanic Physicists “The Anomalies in the WMAP3 data” |
| Jan 2006 | Invited Lecture, McGill University, Canada “The Dark Energy Problem” |
| July 2005 | Public Lecture, U. West Indies, Trinidad, W.I. “Beyond Einstein: The Dark Energy Problem ” |
| May 2005 | Plenary Talk, U. British Columbia |

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| April 2005 | <p>“A Quantum Gravitational Relaxation of the Cosmological Constant” American Physical Society Spring Meeting</p> |
| March 2005 | <p>“Inflationary Gravity Waves and the Matter-Anti Matter Problem” Invited Seminar, Harvard University</p> |
| February 2005 | <p>“Baryogenesis and String Theory” MIT</p> |
| February 2005 | <p>“An Observational Constraint on the Fundamental String Scale” Departmental Colloquium, Duke University</p> |
| December 2004 | <p>“Beyond Inflationary Cosmology” California Institute of Technology</p> |
| October 2004 | <p>“A Signal of Cosmological Birefringence in the CMB” Public Lecture, Duke University</p> |
| October 2004 | <p>“The Real Matrix: An Overview of the New Cosmology” Duke University</p> |
| October 2004 | <p>“Seeing The String: The Cosmic Baryon Asymmetry and a String Realization” University of Michigan</p> |
| July 2004 | <p>“Inflationary Baryogenesis and String Cosmology” Jefferson Lab, Hampton Virginia</p> |
| May 2004 | <p>“The New Cosmology and the Dark Energy Problem” Perimeter Institute, Canada</p> |
| May 2004 | <p>“Matter-Antimatter Asymmetry from Inflationary Gravity Waves” New York University, N.Y., N.Y.</p> |
| Feb 2004 | <p>“Leptogenesis from Gravity Waves in Models of Inflation” UC Berkeley, Berkeley CA</p> |
| Dec 2003 | <p>“Matter-Antimatter Asymmetry from Inflationary Gravity Waves” Harvard University, Cambridge, MA</p> |
| Dec 2003 | <p>“A Unified Baryogenesis Mechanism from Primordial Gravity Waves” Columbia University, N.Y, N.Y</p> |
| Nov 2003 | <p>“A Unified Baryogenesis Mechanism from Primordial Gravity Waves” KITP, UCSB, CA</p> |
| Nov 2003 | <p>“An Overview of D-brane Inflation in String Theory” UC Davis, Davis, CA</p> |
| May 2003 | <p>“Inflation and Quantum Gravity” Cal Tech, Observational Cosmology Group, Pasadena, CA</p> |
| May 2003 | <p>“Inflation and String/M-theory” UCLA , Los Angeles, CA</p> |
| | <p>“Brane Gas Cosmology and M-theory ”</p> |

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| February 2003 | National Society of Black Physicists, Atlanta, GA “Inflation Meets Quantum Gravity” |
| March 2003 | Perimeter Institute, Canada “Brane Gases in The Early Universe” |
| June 2002 | McGill University, Montreal, Canada “Topological Inflation and String Theory” |
| May 2002 | University of Geneva, Geneva, Switzerland “Why are Three Dimensions Large in Our Universe?” |
| February 2002 | Perimeter Institute for Theoretical Physics, Canada “Inflation and String Theory” |
| September 2001 | Institute for Advanced Studies, Princeton, NJ Informal: “A Survey of Transplankian Physics and Inflation” |
| September 2001 | NYU, New York, NY “The Brane Gas Cosmological Scenario” |
| September 2001 | Brown University, Providence, RI “On Tachyon Condensation and Inflation” |
| August 2001 | M-Theory Cosmology, Cambridge University, Cambridge, U.K “The Noncommutative Inflationary Scenario” |
| July 2001 | Corfu Summer Institute, Corfu, Greece “Inflation From D-Brane Annihilation” |
| June 2001 | Columbia University, N.Y. “Emission of Positive Cosmological Constant in the R-S Brane World” |
| July 2001 | NASA Goddard Astrophysics Lab Colloquium “The Interface of M-theory and Cosmology” |
| April 2001 | Public Lecture in London, London, U.K “Superstrings and the Big Bang” |
| March 2001 | Cambridge University, U.K “Inflation from String Theory” |
| December 2000 | Imperial College, U.K “Brane Gases in the Early Universe ” |
| March 2000 | University of British Columbia, Vancouver, Canada “The Varying Speed of Light Scenario from String/M Theory” |
| January 2000 | Aspen Center for Physics, Aspen, CO “VSL from a D-brane Universe” |
| August 1999 | Summerbridge School, Providence, RI “What is a Topological Defect?” |

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| July 1999 | TASI '99 "Strings, Branes and Gravity", Boulder, CO "The Attraction-Annihilation Mechanism in Hybrid Topological Defects" |
| May 1999 | University of The West Indies, Kingston, Jamaica "Common Issues in String Theory and Cosmology" |
| February 1999 | University of British Columbia, Vancouver, Canada "The Interaction of Monopoles and Domain Walls" |
| November 1998 | Brown University, Providence, RI "The Creation of a Universe From an Instanton" |
| July 1998 | Brazilian School of Gravity and Cosmology, Rio de Janeiro, Brazil "The Interaction of Topological Defects" |

Conferences, Workshops, and Schools:

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| Summer 2007 | FQXi Annual Conference, Reykjavik, Iceland |
| Spring 2007 | National Geographic Explorer Symposium, Wash. D.C |
| Summer 2007 | Foundations of Cosmology International Conference, Iceland |
| Winter 2005 | McGill String Cosmology Workshop |
| Summer 2004 | SLAC Summer Institute |
| Fall 2003 | Superstring Cosmology KITP, UCSB, Santa Barbara, CA |
| Summer 2003 | Frontiers of Mathematical Physics PIMS, UBC, Vancouver, Canada |
| Summer 2002 | Frontiers of String Theory and Cosmology Aspen Center for Physics, Aspen CO, U.S |
| Spring 2002 | ICTP String Theory Workshop International Center for Theoretical Physics, Trieste, Italy |
| Summer 2001 | M-Theory Cosmology, Cambridge University, Cambridge, U.K |
| Summer 2001 | DESY Gravity and Particle Physics Workshop Hamburg, Germany |
| Summer 2001 | Corfu Summer Institute on Particle Physics and Cosmology Corfu, Greece |
| Winter 2001 | M-Theory Workshop Ecole Normale Supérieure, Paris, France |
| Winter 2000 | Cosmology at the Millennium Aspen Center for Physics, Aspen CO |
| Winter 2000 | RTN Network "The Quantum Structure of Spacetime" Humboldt University, Berlin, Germany |
| Fall 2000 | Quantum Gravity Workshop, NBI, Copenhagen, Denmark |
| Summer 1999 | TASI 99 "Strings, Branes and Gravity" |

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| | Boulder, CO |
| Summer 1998 | Brazilian School of Gravity and Cosmology Rio de Janeiro, Brazil |
| Summer 1997 | Annual Meeting of National Society of Black Physicists, LBL Laboratories, Berkeley, CA |
| Spring 1997 | National Society of Black Engineers Nashville, TN |
| Spring 1996 | From Quantum Fluctuations to Large Scale Structure: School in Astrophysics and Cosmology Casablanca, Morocco |
| Winter 1995 | Compact For Faculty Diversity Fellows National Conference University of Arizona, Tuscon AZ |

Publications and Papers:

- [1] The Cosmological BCS Mechanism and the Big Bang Singularity
with Tirthabir Biswas
arXiv:0807.4468
- [2] Quantum Gravity as a Fermi Liquid
with Gianluca Calcagni
Foundations in Physics 2008, arXiv:0807.0225
- [3] Superconducting Loop Quantum Gravity and the Cosmological Constant
with Gianluca Calcagni
- [4] Chern-Simons Modified Gravity as a Torsion Theory and its Interaction with Fermions
with Nico Yunes
Phys. Rev D77: 124040, 2008
- [5] A Gravitational-wave Probe of Effective Quantum Gravity
with Lee Samuel Finn and Nico Yunes
Accepted in Phys. Rev D, 2008
- [6] Local Void vs Dark Energy: Confrontation with WMAP and Type Ia Supernovae.
with Tirthabir Biswas, Alessio Notari and Deepak Vaid
astro-ph/0712.0370
- [7] On the Transfer of Adiabatic Fluctuations through a Nonsingular Cosmological Bounce.
with Tirthabir Biswas and Robert Brandenberger
hep-th/0707.4679
- [8] Parametrized Post-Newtonian Expansion of Chern-Simons Gravity.
with Nico Yunes.
hep-th/0704.0299, Accepted to Phys. Rev D (2007)

- [9] A New PPN parameter to test Chern-Simons Gravity.
with Nico Yunes.
hep-th/0703265, Accepted to Phys. Rev Lett.
- [10] Reheating, Dark Matter and Baryon Asymmetry: A Triple Coincidence in Inflationary Models.
with Peter Meszaros
hep-th/0703070
- [11] The Hubble Web: The Dark Matter Problem and Cosmic Strings.
hep-th/0702212
- [12] Gravity Induced Chiral Condensate Formation and the Cosmological Constant.
hep-th/0609066
- [13] Is Cosmic Parity Violation Responsible for the Anomalies in the WMAP Data?
hep-th/0601034, accepted to Phys. Lett B
- [14] A Quantum Gravitational Relaxation of the Cosmological Constant.
hep-th/0503146, Phys.Lett.B629:53-59,2005.
- [15] Fermionic Sectors for the Kodama State
with Kristin Schleich and Donald Witt
SLAC-PUB 10841
- [16] Birefringent Gravitational Waves and the Consistency Check of Inflation
with Jerome Martin
Phys. Rev. D71:063526, 2005
- [17] Can The String Scale be Related to the Cosmic Baryon Asymmetry?
with Jim Gates
hep-th/0409014, JCAP 0606:018,2006.
- [18] In the Realm of the Geometric Transitions
with K. Becker, M. Becker, K. Dasgupta, A. Knauf, R. Tatar
Nucl. Phys. B704:231-278,2005
- [19] The Gravitational Instability of the Vacuum: Insight Into the Cosmological Constant Problem
hep-th/0406202
- [20] Leptogenesis From Gravity Waves in Models of Inflation
with Michael Peskin and M.M Sheikh-Jabbari
hep-th/0403069, Phys.Rev.Lett.96:081301,2006.
- [21] Quantum Gravity and Inflation
with Justin Malecki and Lee Smolin
Phys. Rev. D70:044025, 2004
- [22] The Geometrization of Matter Proposal in the Barrett-Crane Model
and Resolution of Cosmological Problems.
with Marni Sheppard and Louis Crane

gr-qc/0306079

- [23] Nontopological Inflation from Embedded Defects
with Robert Brandenberger and Moshe Rozali
hep-th/0302160
- [24] Brane Gas Cosmology, M Theory and Little String Theory
JHEP 0310:013,2003, hep-th/0212151
- [25] Quintessence and Variation of the Fine Structure Constant in the CMB
with Greg Huey and Levon Pogosian
Phys. Rev. D65:083001,2002
- [26] Noncommutative Inflation
with Robert Brandenberger and Joao Magueijo
Phys. Rev. D67:081301, 2003
- [27] A Thermal Instability for Positive Brane Cosmological Constant in the Randall Sundrum Cosmologies
with Yi Ling and Lee Smolin
Phys. Rev. D65:083503,2002
- [28] Inflation from D-Anti -D-Brane Annihilation
Phys. Rev. D65:023507, 2002
- [29] Noncommutative Geometry as a Realization of Varying Speed of Light Cosmology
with Joao Magueijo
hep-th/010403
- [30] Attractive Forces Between Global Monopoles and Domain Walls
with Robert Brandenberger and Richard Easther
hep-ph/0008014
- [31] Brane Gases in the Early Universe
with Robert Brandenberger and Damien Easson
Phys. Rev. D62:103509,2000
- [32] On the Varying Speed of Light in a Brane Induced FRW Universe
JHEP 0011:017,2000
- [33] On the Interaction of Monopoles and Domain Walls
with Robert Brandenberger, Richard Easther and Andrew Sornborger
hep-ph/9903254